

NOTES ON WILLOWS OF SECTIONS PENTANDRAE AND NIGRAE

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(WITH FOUR FIGURES)

In 1905 the writer began a series of contributions under the title, *Notes on North American Willows*, of which three were published.¹ This general title has been dropped because of the great disadvantage of not being able to indicate clearly, in the title, the content and scope of each paper. For this reason the most recent contribution appeared under a specific title,² as does the present one. These data have been derived from studies incident to the treatment of the genus *Salix* in various floras and manuals of botany.³

The location of the herbarium specimens cited is as follows: B, herbarium C. R. BALL; C, Canadian Geological Survey, Ottawa; D, herbarium C. C. DEAM, Indiana; F, Field Museum, Chicago; FBb, Bebb Herbarium in Field Museum; I, Iowa State Agricultural College; N, United States National Herbarium; N.D., North Dakota Agricultural College; N.M., New Mexico Agricultural College; R, Rocky Mountain Herbarium, University of Wyoming.

SALIX SERISSIMA (Bailey) Fernald.—*S. arguta** *S. pallescens* Anderss. Svensk Vetensk. Acad. Handl. 6:32. 1867.—*S. lucida serissima* Bailey in ARTHUR, Bull. Geol. Nat. Hist. Survey Minn.

¹ BOT. GAZ. 40:376-380. pls. 12, 13. 1905; 60:45-54. figs. 3. 1905; and 60:391-399. 1915.

² BALL, C. R., Undescribed willows of the section Cordatae. BOT. GAZ. 71:426-434. fig. 1. 1921.

³ BALL, C. R., *Salix* in COULTER and NELSON, Man. Bot. Rocky Mt. Region, pp. 128-139. 1909.

———, *Salix* in PIPER and BEATTIE, Flora of the Northwest Coast, pp. 113-118. 1915.

———, *Salix* in P. C. STANDLEY, Flora of Glacier National Park, Contrib. U.S. Nat. Herb. 22:319-324. 1921.

———, *Salix* in CHAS. C. DEAM, Trees of Indiana, revised ed., pp. 34-45. pls. 10-14. 1921.

3:19. 1887.—*S. serissima* (Bailey) Fernald, *Rhodora* 6:7. December 28, 1903.

When this species was established by FERNALD, in the very interesting and comprehensive article cited, he fully set forth its ecological characters and catalogued all available herbarium specimens. These showed its range to extend westward from Connecticut to northern Ohio, Wisconsin, and northern Minnesota. The type locality in Minnesota, and the most westerly station then known, was Mud River, Vermillion Lake, Saint Louis County, lying in the extreme northeastern part of the state, about 75 miles north of Duluth. ROBINSON and FERNALD⁴ extended the range to Alberta, while the writer⁵ has reported the species from Teton County, Montana. SCHNEIDER extends its range eastward to Newfoundland, north to the eastern shore of James Bay and the Severn River in Keewatin, and west to Edmonton, Banff, and Crow's Nest Lake in Alberta. The specimens cited later extend the range southwestward to Pembina and Rolette counties in North Dakota, and to Flathead County in extreme northwestern Montana. Both the Montana specimens come from the east side of the Continental Divide. Teton County lies on the plains at the eastern base of the Rocky Mountains, at an average elevation of about 4000 ft. Choteau is on the Teton River, which arises in the high mountains, but here flows eastward through the plains to the Missouri River. The localities in North Dakota are a southward extension of the distribution in Manitoba, while those in Montana obviously represent a similar extension of its distribution in the mountains of Alberta. It is quite possible that further search will extend the range both north and south in the Rocky Mountains. The Kennicott specimen from Slave River extends the range far to the north of Edmonton, into Athabasca or Mackenzie.

MONTANA.—Choteau County, Choteau, on Teton River, about 4000 ft. elevation, lat. 112°10' W., *Griffiths* and *Lange*, August 22, 1900 (B); Flathead County, 3-4 ft. high in open marsh along Swiftcurrent Creek below Lake McDermott, alt. about 1350 m., *P. C. Standley* 16053, July 20, 1919 (B, N).

⁴ ROBINSON and FERNALD, in GRAY, *New Man. Bot.* 322. 1908.

⁵ BALL, C. R., in COULTER and NELSON, *New Man. Rocky Mt. Bot.* 130. 1909.

ALBERTA.—Crow Nest Lake, Rocky Mountains, *J. Macoun* 39 (Geological Survey Canada 94,440), August 8, 1897 (B); Rocky Mountains Park, Banff, low ground near the village, alt. 4500 ft., *W. C. McCalla* 2252, shrub 6 ft. tall, June 19, 1899 (N); vicinity of Banff, *N. B. Sanson* 304, July 14; 307, 309, 315A, 2167, July 15; 2173, June 27, 1911 (B); Calgary, *J. Macoun* 16 (Geological Survey Canada 94, 336), June 5, 1897 (B); Grattan Creek, near Battle River, *Macoun* and *Herriot* (Geological Survey Canada 70,252), August 17, 1906 (B).

ATHABASCA or MACKENZIE.—Slave River, *R. Kennicott*, July 1860 (N).

MANITOBA.—Bog north of Carberry, *Macoun* and *Herriot* (Geological Survey Canada 70,262), June 11, 1906 (B); near Sidney, *Macoun* and *Herriot* (Geological Survey Canada 70,263), June 12, 1906 (B) (70,264), June 13, 1906 (B).

NORTH DAKOTA.—Rolette County, Turtle Mountains, woods around Upsilon Lake (Fish Lake), *D. C. Mabbott* 464, September 7, 1917 (B); Pembina County, Walhalla, *L. R. Waldron* 1666, August 16, 1902 (B, ND).

ANDERSON in 1867 published *S. arguta** *S. pallescens hirtisquama*, based on a specimen collected by BOURGEOU at Lake Winnipeg and having short aments on short peduncles, scales densely white pilose except at tips, and narrow, sharply serrate leaves. Throughout its range *S. serissima* has short aments and pilose scales, but not narrow and sharply serrate leaves. The three Manitoba specimens cited do have such leaves, and it is quite possible that they represent this form. The leaves are not quite fully developed, and it seems hardly desirable to designate them as belonging to it without more and older material. On no. 70264 the under surfaces of the leaves show scarcely any traces of glaucescence. The leaves of all three are discolored in drying, however, which tends to obscure this character.

On flowering specimens from Manitoba (*Macoun* and *Herriot* 70262) and Alberta (*Sanson* 304, 309, 2167), a peculiar appearance has been observed. The capsules, nearly or quite full sized, but not mature, are minutely roughened or papillate, and the surface, viewed by reflected light, has a striking and deceptive resemblance to a fine lustrous puberulence.

SALIX LASIANDRA Benth.—*S. lasiandra* Benth., Pl. Hartweg, 335. 1857.—*S. speciosa* Nutt., N. A. Sylva. 1: 58. pl. 17. 1843. not HOST, 1828, or HOOKER and ARNOTT, 1832.—*S. arguta lasiandra* Anderss. Svensk. Vetensk. Akad. Handl 6: 33. 1867 (Monog. Sal.).

—*S. lasiandra Lyallii* Sargent, Gard. and For. 8:463. 1895.—*S. Lyallii* (Sarg.) Heller, Bull. Torr. Bot. Club 25:580. 1898.

This beautiful species was described by BENTHAM from a staminate specimen, no. 1954, collected by HARTWEG on the Sacramento River in California. The cotype in the Gray Herbarium is a twig about 12 in. long, not fully in anthesis. The expanding leaves are only 2–4 cm. long and 5–9 mm. wide. The aments are 4 cm. long by 5–9 mm. wide.

The species had previously (1843) been described by NUTTALL from specimens observed abundantly on the Oregon and Wahlamet (Columbia and Willamette) rivers, and occasionally as far east as the Blue Mountains and the Boiseé (Snake) River.

It is a curious coincidence that FENDLER'S no. 816, collected near Santa Fe, New Mexico, and made by ANDERSSON the type of his *S. Fendleriana*, also is a staminate specimen with the aments not yet fully in anthesis and the leaves just unfolding. SCHNEIDER regards this specimen also as representing the true *S. lasiandra* rather than the green-leaved *S. caudata*, because, as he states, in some of the cotype specimens he has examined the leaves are more fully developed and show the glaucous under surface. Two specimens of this number in the National Herbarium are not sufficiently developed to show this.

The range of this species has been discussed recently by SCHNEIDER (Jour. Arnold Arb. 1:17. 1919). Its distribution in Colorado and New Mexico, the southeasternmost extension of its range, is so restricted, and in a way so separated from the remainder, that the specimens known from these two states are listed below, in order to stimulate the interest of botanists.

COLORADO.—Montrose County, Cimarron, Gunnison River, alt. 6900 ft., *C. F. Baker* 141, June 15, 1901 (N); San Miguel County, Norwood Hill, river banks, alt. 7000 ft., *E. P. Walker* 453, August 11, 1912 (N); Archuleta County, Piedra (creek), *E. O. Wooton* 2718, August 12, 1904 (N, NM).

NEW MEXICO.—Rio Arribo County, Nutritas Creek below Tierra Amarilla, alt. 2250 m., *W. W. Eggleston* 6636, April 18–May 25, 1911 (N); meadows, vicinity of Chama, alt. 2380–2550 m., *P. C. Standley* 6645, July 9, 1911 (N); Sante Fe County, Sante Fe Canyon, 9 miles east of Sante Fe, alt. 8000 ft., *A. A. and E. G. Heller* 3637, June 2, 1897 (N); Sante Fe Creek, 4 miles east of Sante Fe, alt. 7500 ft., *A. A. and E. G. Heller* 3719, June 27,

1897 (N); McKinley County, north of Ramah, *E. O. Wooton*, July 25, 1906 (NM); Socorro County, Mogollon Mountains, middle fork of Gila River, alt. about 7000 ft., *E. O. Wooton*, August 4, 1900 (N); west fork of Gila River, alt. 6800 ft., *Wooton*, August 6, 1900 (N, NM); northwest of Mogollon Mountains, Lower Plaza, Frisco, alt. 5800 ft., *Wooton*, July 25, 1900 (N, NM); Frisco River, near Frisco, alt. 5800 ft., *Wooton*, July 25, 1900 (N).

SALIX LASIANDRA *Abramsi*, n. var.—Leaves narrowly lanceolate, 5–11 cm. long, 1–1.7 cm. wide, common sizes 6–7 × 1, 7–8 × 1–1.5, and 9–11 × 1.5 cm., margins shallowly serrulate to subentire; petioles short, 4–8–10 mm. long, thinly pubescent to glabrous, the glands of the distal upper surface small and inconspicuous or wanting; aments short, usually 2–3, sometimes 4 cm. long; capsules 5.5–7 mm. long; pedicels 1–1.5 mm. long.

This variety is named for Professor LEROY ABRAMS, of the Department of Botany of Stanford University, California, well known for his contributions to Pacific Coast botany and collector of the type specimen, his no. 4493, “near Sentinel Hotel, Yosemite Valley, Yosemite National Park, alt. 4000–4500 ft.,” on June 23, 1911. It differs from the species chiefly in the smaller and narrower, less serrulate leaves, and the nearly eglandular petioles. It seems to be limited in its distribution to the Sierra Nevada of central eastern California, from Plumas County, south to Fresno County. Nearly all the specimens collected by DUDLEY in Nevada and El Dorado counties are immature and not identifiable with absolute certainty.

CALIFORNIA.—Sierra County, vicinity of Gold Lake, 1940 m., *W. W. Eggleston* 6263, 6265, August 28, 29, 1910 (N); Nevada County, lower end of Donner Lake, *A. A. Heller* 6879, July 8 (N, St.) 6943, July 16, 1903 (N, St.); vicinity of Donner Lake, *W. R. Dudley* 5007, 5008, June 12; 5018, 5026, 5027, 5049, June 14; Soda Springs station, *Dudley* 5138, June 15; flat land of the Yuba River opposite Cascade, *Dudley* 5149, 5150, June 15; by Truckee River, 1.5 miles below Truckee, *Dudley* 5155, June 17; Independence Lake, by outlet bridge, *Dudley* 5276, 5277, June 19 (all St.); Placer County, Monte Vista, Dutch Flat, *W. R. Dudley* (fol.), August 1909; El Dorado County, Glen Alpine Springs, *W. R. Dudley* 5660, June 1900 (St.); between Glen Alpine Spring and Camp Agazziz, *Dudley* 5664, June 27 (St.); Tallac House, Lake Tahoe shore, *Dudley* 5725, June 28, 1900 (St.); Glen Alpine, 6800 ft., *E. A. McGregor* 204, August 26, 1909 (St); Mariposa County, Mirror Lake, *W. R. Dudley*, June 12, 1894 (St), Yosemite National Park; near Sentinel Hotel, alt. 4000–4500 ft., *L. R. Abrams* 4493 (fem. type), June 23, 1911 (St); Merced Canyon, near Cascade Creek, 3500 ft., *Abrams* 4684, July 12, 1911 (St); Fresno County region of Sidney Creek, 5300 ft., *Hall and Chandler* 360, June 25–July 15 1900 (St).

SALIX CAUDATA parvifolia, n. var.—In the northern part of the range of *S. caudata* is found a form of lower stature and with



FIG. 1.—Portion of type specimen of *Salix caudata parvifolia* n. var. (nat. size) shorter, narrower leaves (fig. 1). It occurs rather commonly and appears to be the dominant form in the mountains of northwestern

Montana and southern Alberta. While examination of a large number of specimens indicates that it passes gradually into the more typical form of the species, as do many other varieties, its recognition as a variety should help to a better understanding of the range of expression in *S. caudata*. Little is known of its height other than the notes given by STANDLEY, which indicate a lower stature than that of the species. The branchlets frequently are shorter and more divaricate; the leaves are very small, 5–8 cm. long, 7–12 mm. wide, seldom exceeding 1 cm. in width, common sizes being 6 cm. × 8 mm., 7 cm. × 9–10 mm., or on sterile shoots 8–10 cm. × 11–16 mm., strongly glandular-serrulate, as are the stipules also. The aments are 2–3 or 3.5 cm. long, rather lax; the scales 3–3.5 mm. long, linear-lanceolate, acute to truncate or toothed, and glabrate. The capsules are 6.5–8 mm. long.

The range of variety *parvifolia* is in the Rocky Mountains from Banff, Alberta, to the Yellowstone Park in Wyoming and the Wahsatch Mountains near Ogden, Utah, also in the mountains of western Idaho and eastern Oregon, and westward in Oregon to the eastern slope of the Cascades in Wasco County.

ALBERTA.—Rocky Mountains Park, *N. B. Sanson* 164 m., June 17, 1911 (B); 265, July 5, 1911 (B); 413, 414, August 21, 1911 (B); 2056, June 22, 1912 (B).

MONTANA.—Flathead County, Glacier National Park, 6–8 ft. high, boggy meadow, along Swiftcurrent Creek, below Lake McDermott, alt. about 1350 m., *P. C. Standley* 16865 (type) August 1, 1919 (N); thicket along lake, abundant, very slender, 6–12 ft. high, vicinity of Glacier Hotel ("Lewis's"), at head of Lake McDonald, alt. 900–1050 m., *Standley* 17906, August 22, 1919 (N); Deer Lodge or Powell counties, Deer Lodge Valley, mountain streams, 5000 ft. elevation, *J. W. Blankinship* 788, m. f., May 27, 1906 (N).

WYOMING.—Yellowstone National Park, Upper Fire Hole Basin, Yellowstone Lake, *J. M. Coulter*, Hayden Survey, July 1872 (N 253728, fr.); along Lamar Creek, *J. N. Rose* 406, fr., August 20, 1893 (N).

IDAHO.—Fremont County, along an irrigating ditch, St. Anthony, *Merrill* and *Wilcox* 899, fr., July 6, 1901 (B, N); Washington County, Weiser, alt. 2200 ft., *M. E. Jones* 6548, July 5, 1899 (N).

OREGON.—Union County, a small tree, bank of Catherine Creek, alt. 3500 ft., *W. C. Cusick* 2385, m. f. fr., May 30, June 28, 1900 (N); Grant County, Prairie City, alt. 1040 m., *W. W. Eggleston* 13700, September 5, 1916 (N); Wasco County, along streams in yellow pines, near head of Warm Springs River, alt. 3000 ft., *E. I. Applegate* 2777, September 7, 1898 (N).

UTAH.—Mountains near Ogden, Hayden's Expedition, 1872 (N, sheet 26198 in part, with *S. lutea* Nutt.).

SALIX LUCIDA Muhl.—I am at a loss to understand the discussion of the distribution of this species by SCHNEIDER. In his discussion of *S. lasiandra* (p. 16) he says:

In 1867 ANDERSSON created two new species: *S. arguta* and *S. lancifolia*. To *S. arguta* he referred his *S. Fendleriana* of 1858 as a synonym, but only "p. p." Nevertheless he cited both specimens upon which he previously based his species, and added to them in the first place a specimen collected by BOURGEOU "ad fl. Saskatchewan, prope Carlton-house." This specimen (I have not yet seen the type in Herb. K.) probably belongs to *S. lucida*, and is identical with one of BOURGEOU'S specimens from the "Saskatchewan, 1859," preserved in Herb. G. Therefore the typical *S. arguta* of ANDERSSON consists of three different things, namely *S. lucida* (Bourgeau)—.

From this it would seem that SCHNEIDER thinks *S. lucida* is represented in Saskatchewan by two collections of BOURGEOU. Under *S. lucida* he states:

There is likewise no proof that it occurs in Manitoba, Assiniboia, Saskatchewan, northeastern Alberta, Athabasca, and the Northwest Territories as far north as Great Bear Lake. Apparently *S. serissima* and *S. lasiandra* have been taken for *S. lucida*, of which the northeasternmost locality from where I have seen material is the Hill (or Hayes) River in Manitoba (*R. Bell*, August 1880, no. 24585, fr.; O.). But it seems very rare (or represented by *S. serissima*) in these regions and in western Ontario, becoming frequent to the east of Lake Huron in southeastern Ontario and southern Quebec.

The first two sentences are contradictory. One says that there is no proof of the occurrence of *S. lucida* in Manitoba, Saskatchewan, etc. The second states that the "northeasternmost" (northwesternmost?) locality from which *S. lucida* is known by him is in Manitoba, and he cites a specimen in the herbarium of the Canadian Geological Survey. Although the writer has seen no specimens of *S. lucida* from Manitoba, there is a strong probability that it occurs in that province. *S. serissima*, however, is much more common there, at least in a narrow-leaved form.

SALIX GOODDINGII Ball.—*S. Gooddingii* Ball, BOT. GAZ. 40: 376. pl. 12, figs. 2. 1905; SCHNEIDER, BOT. GAZ. 65: 12. 1918; SCHNEIDER, Jour. Arnold Arb. 1: 9. 1919.—*S. nigra* of numerous authors, not MARSH.—*S. nigra vallicola* Dudley in ABRAMS, Fl. Los Angeles and vicinity. 100. 1904.—*S. vallicola* (Dudley) Britton, N. A. Trees 184. fig. 141. 1908.

This species was described in 1905 from a single collection of immature and somewhat parasitized pistillate specimens, and at that time placed in the section LONGIFOLIAE. Not long after describing it, I was indebted to Professor W. W. ROWLEE for calling my attention to the fact that the species belonged rather in the NIGRAE, and that GOODDING'S no. 719 represented the staminate plant.



FIG. 2.—*Salix Gooddingii* Ball: large trees on levee at border of Arizona Agricultural Experiment Substation, near Yuma, Arizona, showing form produced in open growth.

Such an error would scarcely have been made if mature specimens had been in hand. In the present instance the type specimen, with its puberulent to pubescent branchlets and tomentose capsules, constitutes so striking a departure from the characters so long associated with the species of section NIGRAE, and agrees superficially so well with those of far western members of the LONGIFOLIAE, that the deception was complete. Recently the writer has studied the numerous older collections of this species as well as some more recent material. Some interesting notes on habit, size, etc., have been obtained by Mrs. AGNES CHASE and the

writer (figs. 2-4). The rather abundant material and the fuller notes now permit a complete description of the plant, as follows:

Shrub 3 mm. tall, to tree 3-9 dm. in diameter and at least 12 and probably 15 m. in height; bark furrowed, gray; branchlets straight, slender, yellowish, glabrous to puberulent, more or less shining, seasonal twigs usually densely pubescent to subpilose; bud scales small, 2-4 mm. long, color and pubescence as in branchlets.

Leaves numerous; stipules 1-3 mm. long, or 8-10 mm. long on vigorous shoots, semicordate to subreniform or sublunate, glandular-denticulate to dentate, often densely glandular on the upper (inner) surface also (see *Ball* 1821, 2069; *Chase* 5517); petioles 3-6 mm. long, yellowish, densely pubescent to glabrate; blades linear-lanceolate, usually somewhat falcate, 8-15 mm. wide, 6-10 cm. long, commonly 8 mm. by 8 cm., on new shoots up to 2.4 by 15 cm., usually acute at base, acuminate at apex, margins finely and shallowly glandular-denticulate with about 8 teeth per cm., green or yellowish green on both sides, often pubescent or puberulent until half grown, usually glabrous at maturity or the midrib beneath permanently pubescent; veins prominent above.

Aments coetaneous, numerous, solitary, terminating lateral leafy peduncles 2-4 cm. long, and bearing 3-6 small leaves; rachis densely pubescent to pilose; scales oblanceolate to lanceolate-oblong, or the staminate obovate, occasionally toothed or even lacerate at apex, 2.5-3 mm. long, yellow, more or less densely pilose, sometimes nearly glabrous on outer apical portion, deciduous; pistillate aments (originally described from immature parasitized specimens) 3-6 or 8 cm. long, 1.5-2 cm. wide, lax; capsules ovate-conic, 5.5-7 mm. long, roughened, thinly to densely pilose with gray hairs at anthesis, becoming glabrous at maturity; pedicels 2-3 mm. long, pilose, becoming glabrous; style less than 0.5 mm. long; stigmas divided, 0.3-0.5 mm. long; staminate aments 4-6 or 7 cm. long, 1-1.2 cm. wide; stamens 5-6, filaments pilose on lower third or half.

S. Gooddingii is found along streams and about springs from southwestern New Mexico to southern Nevada (Lincoln County), Baja California, and thence northward through the interior of California to Tehama County, in



FIG. 3.—*Salix Gooddingii* Ball, showing forms produced under conditions of previous over-crowding; near Yuma Experiment Farm of U.S. Department of Agriculture, in California, near Yuma, Arizona.

the vicinity of Red Bluff. It is most abundantly distributed in the valleys, having an elevation of only 0-200 ft., but ascends the foothills streams to 1500 ft. or more. The specimens listed later are referred to this species. The arrangement is from east and south to west and north. According to SCHNEIDER, this species is found as far east as the Rio Grande Valley in south central New Mexico and in the Davis Mountains of southwest Texas. The material from those districts is discussed later.

NEW MEXICO.—Grant County, Dog Spring, *E. A. Mearns* 183 (tree 25 ft. high, 1 ft. in diam.), May 29, 190 (3?) (N); Dog Spring, Dog Mountains, *Mearns* 2419, September 22, 1903 (N); tree 20 ft. high, Emory Spring, at foot of Emory Peak, *Mearns* 277, June 4, 1902, (N); near Kingston, in meadows, at 6600 ft. elevation, *O. B. Metcalfe* 969, 1904 (N); Mangas Springs, 18 miles northwest of Silver City, alt. 4770 ft., *Metcalfe*, April 26, 1903 (N); Gila, alt. 4200 ft., *E. A. Goldman* 1561, October 9, 1908 (N).

ARIZONA.—Graham County, Sierra Bonita Ranch, 23 miles north of Willcox, *R. A. Oakley*, 1904 (B); Duncan, *J. N. Rose* 11737, April 1908 (N); Cochise County, Ft. Huachuca, *Dr. Edward Palmer* 452, April 26-May 21, 1890 (N); *Dr. Patzky* (?), 1890 (N); *T. E. Wilcox* 63, 1894 (N); Chiricahua Mountains, Joe Smith's Ranch, alt. 5500 ft., *J. C. Blumer* 2306, November 22, 1906 (B); Bonita Canyon, alt. 6500 ft., *Blumer* 2309, November 4, 1906 (B); Santa Cruz County, Nogales, *I. Tidestrom*, March 28, 1908 (B): near Santa Cruz River, east of Nogales, *Tidestrom* 743, March 30, 1908 (B); Sonaita Creek, Patagonia, *F. M. Chamberlain* 5, April 2, 1904 (N); in creek bed at Patagonia, *Tidestrom* 814, April 10, 1908; Calabases, common in bottom lands, *Tidestrom* 870, April 21, 1908 (B), same locality, *Tidestrom* 886, April 24, 1908(B); Pima County, Canoa to Arabaca (Arivaca) *D. Griffiths* 3667, March 13-April 23, 1903 (N); Tucson, *Mearns* 178 (2658) November 21, 1893 (N); *J. J. Toumey*, April 13, May 20, 1894 (N); March, May 16, 1896 (N); *Myrtle Zuck*, May 16, 1896 (N); *G. R. Vasey* 266, March 1881 (N); *J. N. Rose* 11767, April 16, 1908 (N); *Rose, Standley, and Russell* 15192, April 27, 1910 (N); *Blumer* B 16, alt. 2400 ft., April 15, 1907 (B); Santa Cruz River, near Tucson, *Blumer* B 16a, May 10, 1907 (B.N.); Santa Catalina Mountains, alt. 3000 ft., *Blumer* B 17, April 25, 1907 (B.N.); Santa Rita Mountains, Andrade, *Griffiths* 4079, April 18, 1903 (B.N.); Pinal County, near Dudleyville, *Griffiths* 3666, March 13-April 23, 1903 (N); Yuma County, Yuma, State Experiment Substation, *C. R. Ball* 1740, 1741, June 15, 1911 (B,N); *Ball* 1901, May 26, 1915 (B,N); Mohave County, Topock, abundant along Colorado River, alt. 600 ft., *E. A. Goldman* 2970, September 27, 1917 (N); Beaverdam, alt. 1800 ft., *M. E. Jones* 5020, April 5, 1894 (N); Littlefield, near petrified springs, *I. Tidestrom* 9236, April 29, 1919 (B); at spring 8 miles above Pierce's Ferry, alt. 1700 ft., *Jones* 5077u, April 18, 1894 (N); locality unknown, Fremont's Expedition to California, no. 202 (A), 1845 (N), has "Utah" written on label, but "Ariz." added by same hand that added number and date; Beaver Creek, *B. E. Fernow*, August 1896 (N).



FIG. 4.—*Salix Gooddingii* Ball, showing character of bark on large trees, near those shown in fig. 2.

NEVADA.—Lincoln County, Muddy Creek (R) near Virgin River, *L. N. Goodding* 689, (*type*), May 2, 1902 (B, N); Rioville, Colorado River, *Goodding* 719, May 6, 1902 (B, N); along ditches, Bunkerville, *I. Tidestrom* 9202, May 27, 1919 (B); Nye County, Ash Meadows, *Coville* and *Funston* 2145, March 1891 (N), sub nom. *nigra venulosa*.

MEXICO.—Baja California, Seven Wells on Salton River, *E. A. Mearns*, 2869 (Internat. Boundary Commission), April 8, 1894 (N); *L. Schoenefeldt* 2877 (Internat. Boundary Commission) April 9, 1894 (N).

CALIFORNIA.—Mexican Boundary, Unlucky Lagoon, *L. Schoenefeldt* 2918, May 1, 1894 (N); Imperial County, Yuma (Fort Yuma Indian Reservation) pumphouse at ferry, *C. R. Ball* 1741, June 15, 1911 (B); Indian Reservation, *Agnes Chase* 5517, April 7, 1910 (B); Salton Basin, *S. B. Parish* 8092a, June 30, 1912 (B); San Diego County, Bernardo, San Dieguito River, *L. R. Abrams* 3371, May 2, 1903 (N); Pine Valley, *E. A. Mearns* 3977, August 12, 1894 (N); Orange County, Santa Ana River, near Orange, *L. R. Abrams* 3256 (*type* of *S. nigra vallicola* Dudley) April 16, 1903 (N); San Bernardino County, Colton, *M. E. Jones* 3195, April 28, 1882 (N); Fort Mojave, Mojave River, *J. G. Cooper*, March 25, 1861 (N, 319845); undated (N, 319846); Inyo County, on the old Mitchell Ranch, Resting Springs Valley, alt. 525 m., *Coville* and *Funston* 262, February 6, 1891 (N); Furnace Creek Ranch house, Death Valley, *Coville* and *Funston* 469, March 24, 1891 (N); Kern County, on the Tulare Plains, about 10 miles south of Bakersfield, alt. 400 m., *Coville* and *Funston* 1236, July 13, 1891 (N); Tulare County, Hanford, *Alice Eastwood* 3846, 3851, March 24, 1914 (N); Visalia, *Eastwood* 34, May 11, 1894 (N); Madera County, Fresno River, *J. W. Congdon*, June 21, 1903 (N); powerhouse no. 1, San Joaquin River, alt. 1000 ft., *E. G. Dudley* 5, November 1911 (B); San Joaquin County, large tree, 10–18 in. diam., in Tom Payne's or Paradise Cutoff, Tracy pike, about 10 m. south of Stockton, *C. R. Ball* 1929, June 1, 1915 (B, N). Amador County, Sutter Creek, Ione, *C. H. Merriam* 4, September 15, 1905 (letter) (N); South Jackson, 1500 ft., *Geo. Hansen* 198, July 3, 1892 (N); Sacramento County, Sacramento, *L. F. Ward* 89, October 1, 1895 (N); Sacramento Valley, Wilkes Exploring Expedition 1234 (N); Lake County, bank of Cache Creek, *H. N. Bolander* 2678 (N), 1863; Clear Lake (not certainly in Lake County), *J. Torrey* 490 (N), 1865; Yolo County, near Madison, *A. A. Heller* 5419, April 29, 1902 (N); Rumsey, *C. F. Baker* 2936, May 7, 1903 (N), Butte County, Biggs, near United States Experiment Farm, *C. R. Ball* 1820, 1821 (B, N), 1822, 1824 (B), August 15, 1913; same place, *Ball* 1939 June 4, 1915 (B, N); Chico, bank of Chico Creek, *Ball* 2069, June 15, 1916 (B); Tehama County, Red Bluff, *L. E. Smith*, 596, 599, 600, March 26, 1914 (N); 668, 669, May 8, 1914 (N); Shasta County, Reed Creek, *L. E. Smith* 610, March 30, 1914 (N).

In addition to this distribution, SCHNEIDER (BOT. GAZ. 65:12–13. 1918; Jour. Arnold Arboretum 1:9. 1919) credits *S. Gooddingii* with an eastern extension of range to central southern New Mexico and southwestern Texas

(not "northwestern," as SCHNEIDER states). The specimens so determined by him are listed later. Two chief districts are involved. The localities in Dona Ana County, New Mexico, and El Paso County, Texas, are in the Rio Grande Valley near El Paso, Texas. The Davis Mountains are some 100 miles to the southeast, forming part of the watershed between the Rio Grande and the Pecos rivers. I am by no means convinced that all of this material represents *S. Gooddingii* instead of a form of *S. nigra*.

NEW MEXICO.—Dona Ana County, on the White Sands, alt. 3700–4000 ft., *E. O. Wooton*, August 24, 1899 (N, 3 sheets, twigs brown).

TEXAS.—El Paso County, near El Paso, *G. R. Vasey*, March 1881 (N, 2 sheets); *Vasey* 267, April 1881 (N, 2 sheets); *V. Havard*, November 1881 (N); without locality, *Havard*, 1881 (N 264239); Mexican Boundary Survey, chiefly in the valley of the Rio Grande below Donana, *Parry, Bigelow, Wright, and Schott* 1357 (N); Jeff Davis County (probably), Fort Davis, *V. Havard*, April 1885 (N); Davis Mountains, *S. M. Tracy* 187, April 24, 1902 (N); Tom Green County, Knickerbocker Ranch, along Dove Creek, *Frank Tweedy*, May 1880 (N) (strongly suggests *S. nigra Lindheimerii* Schn.).

SALIX LAEVIGATA araquipa (Jepson), n. var.—*S. laevigata* forma *araquipa* Jepson, Fl. Calif. 339, 1909.—The original description by JEPSON reads as follows:

Forma *araquipa* Jepson, n. form. Small tree; one-year-old shoot with dense close tomentum; brown tuft of hairs on old wood at base of season's shoot very conspicuous; leaves reddish brown above; catkins long and dense. Arbor parva ramulis annotinis cum denso appresso tomento; valde manifestus caespes fusci pili basi horni ramuli in ligno vetere; folia rufo-fusca supra; amenta longa artaque.—Dry gulches, Araquipa Hills, Solano County, May 2–6, 1891, W. L. J.

The type came from "dry gulches, Araquipa Hills, Solano County (California), May 2–6, 1891, *W. L. Jepson*." This county lies northeast of San Francisco. I have not seen the type specimen, but an examination of the material in the National Herbarium, as well as that in my own herbarium, shows that this variety is found rather rarely in central California, but occurs commonly in the southern part of the state, comprised in Los Angeles, Orange, Riverside, San Bernardino, and San Diego counties. The vesture of the seasonal twigs, the buds, the petioles, and even the basal portion of the midrib, especially beneath, makes such a striking contrast with the glabrous and shining epidermis of the typical form that forma *araquipa* seems worthy of varietal rank. It should be noted, however, that the conspicuous tuft of brown hairs

at the base of the seasonal shoots is found on many specimens of which the shoots themselves are glabrous. The following specimens are referred to this variety:

CALIFORNIA.—Sonoma County, near Sonoma, *A. A. Heller* 5348, April 23, 1902 (N); San Bernardino County, San Bernardino, *G. R. Vasey* 265, February 1881 (N); *S. B. and W. F. Parish* 1204, 1881 (N); alt. 300 m., *J. B. Leiberg* 3243, 3244, both in part, April 4, 1898 (N); Los Angeles County, Rivera, *E. Braunton* 364, May 10, 1902 (N); Los Angeles River near Rivera, *L. R. Abrams* 3253, April 14, 1903 (N); San Francisquito Canyon, elevation 1500 ft., *W. M. Moore*, October 7, 1912 (B); Orange County, Santiago Canyon in Santa Ana Mountains, *V. Bailey* 1185, July 17, 1907 (N); Riverside County, Baranca, in mountains east of Pigeon Pass, *F. M. Reed* 2279, March 15, 1908 (N); San Diego County, Campo, by streams, *C. G. Pringle* 332, April 18, 1892 (N); Fall Brook, *M. E. Jones* 2870, March 25, 1882 (N); Jacumba Hot Springs, near Monument 233, *E. A. Mearns* 3245, May 20; 3322, May 28, 1894 (N); Warner's Hot Springs, *Alice Eastwood* 2589, April 9, 1913 (N).

ARIZONA.—Beaver Creek, *B. E. Fernow*, August 1896 (sub nom. *amygdaloides*) (N).

SALIX LONGIPES WARDII (Bebb) Schneider.—*S. nigra Wardii* Bebb, U.S. Nat. Mus. Bull. 22. 114-115. 1881.—*S. longipes Wardii* (Bebb) Schneider, BOT. GAZ. 65:22. 1918.

So far as known, this species has not been reported heretofore from any station north of the Ohio River. In the autumn of 1918, a specimen collected on the banks of the Ohio, in Perry County, Indiana, was found in a collection of Indiana willows received for identification from CHARLES C. DEAM, State Forester of Indiana. On asking his interest in getting more material, he was kind enough to visit the spot again in 1920 and make another collection. Both specimens show only the characteristic foliage, but there can be no doubt of their identity.

INDIANA.—Perry County, low bank of Ohio River about 6 miles east of Cannelton, *Chas. C. Deam* 26749, September 24, 1918 (B,D); same place, a sprawling shrub growing in crevices of rock, the branches about 3 ft. tall, probably submerged during the winter, at least, *Deam* 33220, October 1, 1920 (B, D).

The recorded northern range of the species is from Washington, D.C., northwestward up the Potomac Valley to Alleghany County, Maryland, and westward in Upshur County, West Virginia (about lat. 39° N.), and Fayette County, Kentucky (about lat. 38° N.). Neither Upshur County nor Fayette

County is near the Ohio River, although the latter is in the same latitude as Perry County, Ohio, and less than 100 miles east of it.

SALIX AMYGDALOIDES Andersson.—This species is mentioned only to note extension of its range into two states excluded by SCHNEIDER, who in the main has set very accurate boundaries for its distribution. These states are Arizona and New Mexico. These specimens bear mature ovate-lanceolate leaves, and there can be no doubt of their identity, as those of *S. Wrightii* are linear-lanceolate and shorter-petioled.

ARIZONA.—Navajo Indian Reservation, Tunicha Mountains, 7000 ft., *E. A. Goldman* 2909, August 20, 1917 (N).

NEW MEXICO.—San Juan County, near Farmington, 1550–1650 m.; *P. C. Standley* 7047, July 19, 1911 (N); Navajo Indian Reservation, vicinity of Shiprock Agency, 1425 m. elevation, *Standley* 7867, August 11, 1911 (N).

These localities are in the extreme northeastern corner of Arizona and the extreme northwestern corner of New Mexico, respectively.

It may be worth noting also that the excellent survey of Indiana being made by CHAS. C. DEAM, State Forester, shows, by specimens I have seen, that *S. amygdaloides* occurs in fifteen counties in the northern third of the state (3–4 tiers of counties), and at two outposts, Henry and Marion counties in the central part of the state.

BUREAU OF PLANT INDUSTRY
WASHINGTON, D.C.